International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 9 Issue 2, Mar-Apr 2025 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Big Data in Supply Chain

Matthew N. O. Sadiku[1], Paul A. Adekunte[2], Janet O. Sadiku[3]

[1]Roy G. Perry College of Engineering, Prairie View A&M University, Prairie View, TX, USA
[2]International Institute of Professional Security, Lagos, Nigeria
[3]Juliana King University, Houston, TX, USA

ABSTRACT

An enormous amount of data is generated tremendously every second within supply chain industry all over the world. Big data is an extensive compilation of information that standard data-processing software finds challenging to manage. It refers to the vast amounts of data, structured and unstructured, that helps businesses to establish trends and patterns in human behavior and interactions. Big data has become a big business. Big data in supply chain refers to the vast amount of structured and unstructured data collected throughout various stages of a supply chain, which can be analyzed to improve operational efficiency, optimize inventory management, enhance demand forecasting, and make better data-driven decisions. The role of big data in supply chain is pivotal in improving demand forecasting, inventory management, risk resilience, and personalized customer experiences. This paper explores how big data is widely optimized and managed in the supply chain industry.

KEYWORDS: *big data, big data analytics, supply chain, supply chain management*

How to cite this paper: Matthew N. O. Sadiku | Paul A. Adekunte | Janet O. Sadiku "Big Data in Supply Chain" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-9 | Issue-2, April 2025, pp.128-139, URL: www.ijtsrd.com/papers/ijtsrd76263.pdf

IJTSRD76263

INTRODUCTION

The supply chain involves a series of systematic processes in converting the raw material into finished products and transporting it to the distributor, which is then made available to the consumers. In a traditional business model, supply chains comprise a series of companies working together to deliver value by transforming raw material into a finished product. Each company adds value to the product or service to transform the raw materials in one location and deliver a finished product to the end customer through value creation and trade. Figure 1 illustrates supply chains [1].

Any enterprise supply chain directly produces a great amount of data. These volumes are too large for traditional data processing applications to handle. Modern organizations should consider this vast expanse of data an invaluable resource and implement best practices and tools that allow them to leverage it most effectively. Big data is altering how supply chain decision-makers make choices. The power of big data (speed, diversity, and volume) is changing supply chain decision-making. The role of big data in supply chain is pivotal in improving demand forecasting, inventory management, risk resilience, and personalized customer experiences. The use of big data in supply chain analysis and management projects is integral for optimized planning, operational efficiency, production, order fulfillment, and customer satisfaction.

WHAT IS BIG DATA?

Big data applies to data sets of extreme size (e.g. exabytes, zettabytes) which are beyond the capability of the commonly used software tools. It involves situation where very large data sets are big in volume, velocity, veracity, and variability [2]. The data is too big, too fast, or does not fit the regular database architecture. It may require different strategies and tools for profiling, measurement, assessment, and processing. The cloud word for big data is shown in Figure 2 [3].

Big Data is essentially classified into three types [4]:

- *Structured Data:* This is highly organized and is the easiest to work with. Any data that can be stored, accessed, and processed in the form of fixed format is known as a structured data. It may be stored in tabular format. Due to their nature, it

is easy for programs to sort through and collect data. Structured data has quantitative data such as age, contact, address, billing, expenses, credit card numbers, etc. Data that is stored in a relational database management system is an example of structured data.

- *Unstructured Data:* This refers to unorganized data such as video files, log files, audio files, and image files. Any data with unknown form or the structure is classified as unstructured data. Almost everything generated by a computer is unstructured data. It takes a lot of time and effort required to make unstructured data readable. Examples of unstructured data include Metadata, Twitter tweets, and other social media posts.
- *Semi-structured Data:* This falls somewhere between structured data and unstructured data, i.e., both forms of data are present. Semi-structured data can be inherited such as location, time, email address, or device ID stamp.

The different types of big data are depicted in Figure 3 [5].

The process of examining big data is often referred to big data analytics. It is an emerging field since massive computing capabilities have been made available by e-infrastructures [6]. Big data analytics is the application of advanced analytic techniques to large, heterogeneous data sets that comprise structured, semi-structured, and unstructured data from many sources with sizes ranging from terabytes to zettabytes.

Analytics include statistical models and other methods that are aimed at creating empirical predictions. Data-driven organizations use analytics to guide decisions at all levels. Several techniques have been proposed for analyzing big data. These include the HACE theorem, cloud computing, Hadoop, and MapReduce [7].

CHARACTERISTICS OF BIG DATA

Big data is growing rapidly and expanding in all science and engineering, including physical, biological, and medical services. Different companies use different means to maintain their big data. As shown in Figure 4 [8], big data is characterized by 42 Vs. The first five Vs are volume, velocity, variety, veracity, and value.

- *Volume*: This refers to the size of the data being generated both inside and outside organizations and is increasing annually. Some regard big data as data over one petabyte in volume.
- *Velocity*: This depicts the unprecedented speed at which data are generated by Internet users, mobile users, social media, etc. Data are generated and processed in a fast way to extract useful, relevant information. Big data could be analyzed in real time, and it has movement and velocity.
- *Variety*: This refers to the data types since big data may originate from heterogeneous sources and is in different formats (e.g., videos, images, audio, text, logs). BD comprises of structured, semi-structured or unstructured data.
- *Veracity*: By this, we mean the truthfulness of data, i.e. weather the data comes from a reputable, trustworthy, authentic, and accountable source. It suggests the inconsistency in the quality of different sources of big data. The data may not be 100% correct.
- *Value*: This is the most important aspect of the big data. It is the desired outcome of big data processing. It refers to the process of discovering hidden values from large datasets. It denotes the value derived from the analysis of the existing data. If one cannot extract some business value from the data, there is no use managing and storing it.

On this basis, small data can be regarded as having low volume, low velocity, low variety, low veracity, and low value. Additional five Vs has been added [9]:

- *Validity:* This refers to the accuracy and correctness of data. It also indicates how up to date it is.
- *Viability:* This identifies the relevancy of data for each use case. Relevancy of data is required to maintain the desired and accurate outcome through analytical and predictive measures.
- *Volatility:* Since data are generated and change at a rapid rate, volatility determines how quickly data change.
- *Vulnerability:* The vulnerability of data is essential because privacy and security are of utmost importance for personal data.
- *Visualization:* Data needs to be presented unambiguously and attractively to the user. Proper visualization of large and complex clinical reports helps in finding valuable insights.

Instead of the 10V's above, some suggest the following 5V's: Venue, Variability, Vocabulary, Vagueness, and Validity) [9].

Industries that benefit from big data include the healthcare, financial, airline, travel, restaurants, automobile, sports, agriculture, and hospitality industries. Big data technologies are playing an essential role in farming: machines are equipped with

sensors that measure data in their environment. Structured and unstructured data are generated in various types [10-13].

BIG DATA IN SUPPLY CHAIN

Like its name, big data refers to the entire amount of data collected during a process, including any form of structured, unstructured or semi-structured data. Big data in the supply chain refers to the structured and unstructured data gathered at various stages. It provides a comprehensive view that enhances process visibility, improves demand forecasting, and optimizes inventory management. Big data supply chain streamlines operations, reduces costs, and enhances customer satisfaction by enabling proactive responses to obstacles. In today's rapidly evolving world, the logistics and supply chain industry faces numerous challenges. Big data has become an invaluable asset in the logistics and supply chain industry. From globalization to customer demands for faster deliveries, companies need to continuously optimize their operations. Source examples of big data in supply chain include IoT devices, enterprise resource planning (ERP) systems, customer feedback, and external data about weather.

Supply chain analytics is the process by which companies and industries combine the available data from multiple systems to examine and analyze the various functions of the supply chain. It refers to the collection of data and information that provide insights into logistics performance, from inventory management to fulfilling and shipping orders. Supply chain analytics are guiding managers into the future with data-driven decision making. Advanced analytics is likely to become a decisive competitive asset in many industries and a core element in companies' efforts to improve performance. Figure 5 shows supply chain analytics [14].

In an era defined by globalization, just-in-time manufacturing, and customer-centricity, supply chain management has become a critical component of business success. To thrive in this competitive landscape, organizations are turning to big data analytics as a powerful tool to optimize their supply chain operations.

Big data analytics leverages the vast volumes of data generated within and outside an organization's supply chain. Typical data sources in the supply chain include [15]:

- IoT in equipment, vehicles, and facilities tracks temperature, location, speed, and machine performance.
- Enterprise resource planning (ERP) systems capture essential internal data, including inventory levels, order statuses, procurement, and financials.
- Data from customer reviews and service interactions provide insights into product satisfaction, delivery times, and areas for improvement.
- Weather conditions and real-time traffic are crucial for managing disruptions and optimizing routes.

By leveraging data from real-time tracking systems, ERP systems, and social media, businesses can gain a holistic understanding of both internal operations and external influences on their supply chains.

BIG DATA SUPPLY CHAIN EXAMPLES

The ecommerce giants use big data to better meet customer demands. They utilize big data analytics in the supply chain to analyze their products or services, optimize the various supply chain operations, predict consumer behavior, and manage inventories. Successful big data in supply chain examples include Procter & Gamble, Amazon, General Electric, Siemens, DHL, Nestlé, Walmart, UPS, Coca-Cola, and Starbucks. Some of these companies are displayed in Figure 6 and explained as follows [15]:

- *Procter & Gamble:* The collaboration between Procter & Gamble (P&G) and its retail partners is an excellent example of leveraging big data for vendor-managed inventory. By sharing real-time sales data and inventory levels, P&G and its partners can proactively manage stock replenishment, resulting in reduced out-of-stock situations and improved sales performance. Big data helps companies reduce unnecessary steps and integrate data-driven decisions. For example, in India, Procter & Gamble has achieved a 60% reduction in supply chain touchpoints compared to previous years. It led to faster operations, lower costs, and improved efficiency.
- *Amazon:* Amazon has a drive to deliver its orders to customers faster than its rivals. It uses data analytics to optimize its vast network of fulfillment centers, ensuring that products are strategically placed to minimize delivery times. Amazon deployed over 104,000 Amazon Monitron sensors to monitor 34,810 assets across 192 factories. Using big data for supply chain, the company achieved a 69% reduction in unplanned equipment downtime, saving approximately $37.83 million.
- *General Electric:* Digital twin technology enables real-time simulation and optimization of physical assets or processes. General Electric's Proficy

CSense uses process digital twins to address challenges like demand fluctuations and workforce gaps, reducing product waste by 75%, quality complaints by 38%, and increasing throughput by 5%-20%.

- *Siemens:* 56% of food and beverage companies face at least one recall per year, incurring €9.5 million in direct costs and an additional €50-60 million in lost sales and reputational impacts. Siemens uses blockchain and IoT platform MindSphere to achieve full traceability and manage recalls and counterfeiting.
- *DHL:* DHL, a global logistics provider, uses big data analytics to optimize its freight operations. By analyzing historical shipping data and external factors such as weather patterns and port congestion, DHL can identify potential delays and take necessary actions to mitigate risks. DHL forecasts delivery volumes with 90-95% accuracy, optimizing courier routes based on real-time shipment data. AI-powered software from Wise Systems then fine-tunes the route in seconds, considering delivery priorities and time-sensitive requirements.
- *Nestle:* Deloitte and Nestlé USA collaborated to build a Microsoft Azure Data Lake, breaking data silos. The solution supported 400+ reports and integrated 15+ data sources, providing summarized reporting and insights for executives. Over four years, it has generated $200+ million in business value.
- *Walmart:* Walmart started using big data to track sales and inventory in 2003. It was able to reduce the time it takes to get products from its suppliers to its stores by 10% by using big data. Walmart employs data analytics to enhance inventory management and reduce stockouts, ultimately improving customer satisfaction. Walmart avoided 94 million pounds of CO_2 emissions, eliminated 30 million unnecessary miles, and optimized routes to bypass 110,000 inefficient paths, winning the 2023 Franz Edelman Award. Walmart utilizes big data analytics to monitor product sales and inventory levels, enabling them to proactively restock shelves. Figure 7 shows a typical Walmart store [16].
- *UPS:* UPS was able to reduce the average delivery time for its packages by 5% by using big data. UPS uses big data analytics in supply chain management through tools like Deal Manager. This system provides real-time pricing insights for small-to-medium business deals, achieving an 80% win rate. Currently, 95% of deals under $1 million utilize this tool. Every step of UPS's shipping process includes supply chain data analysis. Overall, UPS has saved 1.6 million gallons of gasoline in its trucks each year, greatly lowering delivery costs.
- *Coca-Cola:* By analyzing sales data and market trends, Coca-Cola forecasts demand with 90% accuracy, predicting consumer needs better and adjusting production schedules in real time. This improvement helps minimize excess inventory and associated costs while ensuring that high-demand products are available.
- *Starbucks:* With 90mn transactions made weekly across more than 25,000 stores, Starbucks is a renowned brand worldwide. The introduction of rewards apps via mobile devices has allowed the company an insight into its customers spending habits. Another way that Starbucks reaches customers is through targeted and personalized marketing.

APPLICATIONS OF BIG DATA IN SUPPLY CHAIN

At its core, big data is an extensive compilation of information that standard data-processing software finds challenging to manage. The promising applications of big data and how it might "revolutionize" the supply chain are hard to ignore. Common areas of applications of big data in supply chain include the following [17,18]:

- *Demand Forecasting:* The ability to foretell what lies on the horizon has long been something companies strive to have. Big data can help provide great insights into customers' and markets' behavior. For the supply chain, it enables in-depth and granular demand forecasting. Big data is used to create predictable patterns by analyzing historical data and market trends to predict customer behavior, highs, and lows of seasons, managing inventory and even how to provide a competitive edge using customized customer experiences. Companies could better anticipate potential demand and its changes through information like sales figures, social media, market trends, and weather forecasts. This helps optimize inventory levels, minimizes overstocking/stockouts, and enhances consumer satisfaction.
- *Warehouse Management:* Effective warehouse management is crucial for quick ordering fulfillment as well as inventory management. Big data analytics may give real-time insight into the warehouse's operations, which allows businesses to increase the efficiency of the level of

inventory, monitor the movement of stock, and increase the overall efficiency of warehouses.

- *Optimum Facility Location:* Setting up a new facility is a massive capex expense for any company. Leveraging big data helps reduce the chances of error for such critical decisions. It helps businesses determine where to put brand-new warehouses and distribution centers. They can identify the ideal places for the lowest delivery times and expenses, combining information on customer locations, demand nodes, shipping times, and costs.
- *Supply Chain Risk Management:* Supply chain risk management is essential to your operational success. In the supply chain risk management process, big data can serve as a crucial asset. It allows companies to track and analyze large volumes of data that, when correctly processed, can reveal compelling insights. Supply chain risk management is all about identifying, assessing, and mitigating risks in your supply network. It involves careful planning and the use of tools, such as supply chain risk management software, to provide actionable insights. Big data analytics helps anticipate and determine supply chain risks in advance and help control them in time. Recognizing trends and patterns could help businesses prepare for disruption and take proactive actions. Big data can also help keep plan Bs ready and activate them immediately in case of an adverse supply chain event.
- *Supplier Performance:* Big data analytics helps businesses better measure and evaluate supplier performance. Continuous improvement metrics may be monitored and analyzed with big data, including delivery times, quality standards, and adherence. This provides improved insights into supplier performance, resulting in closer, much more cooperative relationships. Such step-by-step improvements unlock the power of a collaborative supply chain, leading to a more dependable and robust end-to-end supply chain.
- *Tracking:* Big data tracking allows supply chain managers to monitor the movement of goods, inventory levels, and production processes in real-time. It can significantly benefit supply chains by providing real-time visibility, predictive analytics, optimization capabilities, and improved decision-making. Big data tracking allows for overview, evaluation, and improvement of various supply chain processes, such as route planning, inventory management, and production scheduling. Tracking also allows companies to track changes in their customers' behavior, such as shifts in buying habits, interests, and satisfaction levels. Through analysis of this data, companies can better tailor their output, including services and products, and strengthen customer satisfaction and loyalty. Platforms built on big data use technology to track each item by its unique product number and delivery address to ensure customers receive their correct orders on time. Figure 8 shows tracking systems in the supply chain [15].
- *Real-time Visibility:* Big Data and IoT sensors provide real-time visibility into supply chain operations. This includes tracking the movement of goods, monitoring environmental conditions, and capturing data on production processes. This supply chain visibility plays a vital role in identifying blockages and inefficiencies in the chains, allowing companies to input corrective action swiftly.
- *Supply Chain Disruptions:* In today's interconnected global economy, supply chain disruptions can have severe consequences. Supply chain disruptions are a critical concern for businesses, as they can lead to significant operational challenges and financial losses. These disruptions can originate from a variety of sources, each with its own set of complications and required management strategies. Properly addressing these disruptions not only minimizes the immediate impacts on supply chain operations but also strengthens long-term resilience and reliability. Disruptions from natural disasters can cripple key infrastructure, leading to severe logistical setbacks. Market fluctuations can cause rapid changes in both supply and demand, disrupting established procurement and financial strategies. The data can help predict, respond to, and recover from supply network disruptions.
- *Predictive Analysis:* Predictive analytics, business analytics, big data analytics, and supply chain analytics are examples of quantitative and qualitative analyses. Big data analysis is highly effective when planning sales strategies and scaling your business. It may be utilized to boost market competitiveness while also improving data quality management and user experience. Big data allows you to explore consumer trends and better forecast demand. It helps to improve operational efficiency and reduce costs throughout the fulfillment process and entire supply chain. Big data is not biased. It is fact-based with numbers that show the broad picture of how your business is performing. With predictive analytics, logistic companies can spot

patterns, anticipate fluctuations in demand and improve storage space usage.

- *Food Supply Chain:* The world's food supply is increasingly integrated. For example, maize from different regions of the world is traded in international markets and transported to most continents. The complexity of the network has led to data-driven systems being used to manage the supply chain. As the world becomes increasingly connected, the need for efficient and reliable food supply chains has never been greater. Big data is playing an increasingly important role in controlling food supply chains, from farm to table. It is being used to track consumer behavior. This information can be used by manufacturers and retailers to ensure that they are meeting consumer demand. It can also be used to help identify new trends and develop marketing strategies. Figure 9 shows a food supply chain [19].

BENEFITS

Big data offers numerous benefits for supply chain management, such as enhancing visibility across the network, improving demand forecasting, and optimizing logistics. Smart business decisions are made by using data. Data analytics can aid in the smooth and effective operation of supply chains. It can assist supply chains in optimizing their routes and schedules, as well as tracking their success over time. Other benefits include the following [15,20]:

- *Enhanced Demand Forecasting:* Big data and supply chain enable more accurate demand forecasting by analyzing historical sales data, market trends, and real-time conditions. They adjust inventory in real time to avoid overstocking items unlikely to sell and ensure that popular items are available.
- *Better Visibility and Transparency:* One of the significant benefits of big data in logistics and supply chain management is improved visibility across the entire value chain. Big data consolidates information across all supply chain stages, from raw materials to warehousing and delivery. Also, you can analyze data from manufacturing and assembly lines to identify bottlenecks or inefficiencies.
- *Inventory Optimization:* By aligning stock levels with actual demand, you avoid overstocking, which ties up working capital and increases holding costs. Real-time data enables businesses to quickly restock fast-moving items and ensure products are available when customers want them.
- *Route Optimization:* Logistics companies deal with complex transportation networks and face challenges in finding the most efficient routes for deliveries. Big data analytics helps optimize routes by considering factors such as traffic conditions, weather patterns, and historical delivery data.
- *Efficiency:* Using big-time data in the various supply chain industries helps in figuring out the pros and cons, tackling future potential risks, and changing development strategies in the industry. It helps in minimizing the inefficiencies and enhancing productivity.
- *Optimization:* One of the key areas where big data has made a significant impact on supply chain management is in optimization. By analyzing vast amounts of data related to inventory levels, production schedules, transportation routes, and customer demand, companies can identify areas for improvement and make data-driven decisions to optimize their supply chain operations.
- *Risk Assessment:* Analytics can assess supply chain risks by analyzing historical data and external factors. By identifying potential risks and vulnerabilities, organizations can develop contingency plans and strategies to mitigate them.
- *Last-Mile Delivery:* The last-mile delivery, often the most expensive and challenging part of the supply chain, benefits from analytics. Data on customer locations, delivery preferences, and traffic conditions help companies optimize last-mile logistics.
- *Improved Logistics and Transportation:* Real-time data from GPS, traffic updates, and weather conditions allow companies to adjust delivery routes on the fly. By tracking vehicle performance and fuel usage and optimizing routes, you will reduce expenses and stay more sustainable.
- *Personalized Customer Experience:* Supply chain and big data enable supply chains to become more customer-centric by tailoring offerings and services. Providing timely, accurate, and personalized service builds trust and customer satisfaction, increasing long-term revenue potential.
- *Sustainability:* Big data analytics helps monitor and manage ethics and sustainability in supply chains. It can enable effective product trailing from procurement to delivery. Companies can track products' sourcing, production, and transport to meet environmental and social requirements. This lessens the carbon footprint, enhances the

company's reputation due to ethical sourcing, and meets customer needs for environmentally and socially responsible business practices.

- *Integration:* For effective integration of big data into supply chain risk management, it is essential to ensure that the data is clean, relevant, and accurate. Clean data means that the information is free from errors and discrepancies. Ensuring relevance involves aligning the data collected with the specific risk management needs of the supply chain. Accuracy is critical as it enhances the reliability of the insights generated from the data analysis.
- *Collaboration:* Big data analytics facilitates collaboration among various stakeholders in the supply chain, including suppliers, manufacturers, distributors, and retailers. By sharing relevant data and insights, companies can improve coordination, synchronize production schedules, and optimize inventory levels.
- *Traceability:* Big data and analytics enable end-to-end traceability of products. This is crucial for product recalls, quality control, and compliance with regulatory requirements.

Some of these benefits are displayed in Figure 10 [15].

CHALLENGES

In spite of the immense benefits of big data for supply chain management, many challenges prevent efficient use and implementation. Among the most pressing issues are data security and privacy concerns. One of the biggest challenges is the sheer volume of data generated through various sources. Another challenge is the quality of the data. Addressing these challenges is crucial for businesses looking to leverage big data. Other challenges include the following [15]:

- *Ethical Concern:* Within the big data industry, data is passed from one firm to the next within an information supply chain. All supply chains carry ethical issues both downstream and upstream. Software companies must ensure that their products are not eventually sold in Syria through a distribution center in Dubai. Data aggregators or data brokers may sell the information to researchers, government agencies or polling companies. Selling information increases the risk of secondary misuse of the data, with eventual harmful impacts on users. The harm resulting from the use of big data can also be identified by asking whether individuals' rights are being realized in the process of using the data.
- *Data Privacy:* Ensuring data privacy becomes increasingly complex in a regulatory environment that is both strict and varied across regions.
- *High Cost of Implementation:* Big data analytics in logistics and supply chain management often require significant upfront investment in infrastructure, technology, and training. Small and medium-sized enterprises may struggle with these expenses.
- *Data Quality and Integration:* Supply chains generate large volumes of data from diverse sources, and integrating them into a cohesive format for analysis is complex. Inconsistent or poor-quality data can lead to incorrect decisions and operational inefficiencies.
- *Lack of Skilled Workforce*: Data analysis is a growing job opportunity since every supply chain industry uses big data analytics to enhance efficiency. Data scientists, analysts, and IT specialists are in high demand, and small and medium-sized enterprises often struggle to recruit and retain talent. This can slow down the adoption and effective use of supply chain and big data analytics.
- *Change Management:* Employees may be reluctant to adopt new technologies, fearing job displacement or a steep learning curve. Introducing big data requires significant shifts in organizational processes, roles, and mindsets. Clearly communicate the pros of big data analytics for supply chain and how it will improve operations, not replace jobs. The goal is to foster a data-driven culture where the workforce is not only comfortable with big data tools but also sees them as invaluable assets in optimizing procurement outcomes.
- *Cybersecurity:* There is the challenge of data security. With the large volumes of data generated through various sources, there is a risk of data breaches and cyber-attacks. As the volume of data increases, so does the potential for breaches, which can jeopardize sensitive information and disrupt operations. The digitalization of supply chain processes has exposed businesses to increased risks of cyber-attacks. To effectively manage big data in supply chain management, businesses need to invest in cybersecurity measures that can protect their data from potential threats.

Some of these challenges are depicted in Figure 11 [15].

CONCLUSION

Big data is a term used to describe a massive amount of data that is generated from various sources. This data can be used to track and analyze trends in order to better understand and manage supply chains. Big data analytics has emerged as a game-changer, enabling businesses to gather, analyze, and leverage massive amounts of data to make informed decisions and drive innovation. Big data applications in supply chain management enable companies to analyze vast datasets for critical insights, enhancing inventory optimization, demand forecasting, and risk management. The ever-increasing reliance on big data is altering the landscape of supply chains as we know it. The transition to data-driven decision making is reshaping the supply chain landscape and has far reaching implications for how businesses function. Big data is turning supply chain managers into "mind readers," allowing them to predict and react to buyer behaviors in new ways.

Big data analytics has emerged as an integral force in the supply chain. The role of big data in supply chain management has been rapidly evolving and growing in recent years. As big data evolves, so does its importance in supply chains. As we move towards a more data-driven and digital future, companies that harness the power of big data will be well-positioned to succeed in the ever-evolving business landscape. More information about big data in the supply chain industry can be found in the books in [21-25] and a related journal: *International Journal of Logistics Research and Applications.*

REFERENCES

[1] "The big data industry's supply chain," Unknown Source.

[2] M. N. O. Sadiku, M. Tembely, and S.M. Musa, "Big data: An introduction for engineers," *Journal of Scientific and Engineering Research,* vol. 3, no. 2, 2016, pp. 106-108.

[3] "Big data optimisation and management in supply chain management: a systematic literature review," *Open access,* vol. 56, June 2023, pp.253-284.

[4] "The complete overview of big data," https://intellipaat.com/blog/tutorial/hadoop-tutorial/big-data-overview/

[5] R. Allen, "Types of big data | Understanding & Interacting with key types (2024)," https://investguiding-com.custommapposter.com/article/types-of-big-data-understanding-amp-interacting-with-key-types

[6] P. Baumann et al., "Big data analytics for earth sciences: The earthserver approach," *International Journal of Digital Earth*, vol. 19, no. 1, 2016, pp.3-29.

[7] X. Wu et al., "Knowledge engineering with big data," *IEEE Intelligent Systems*, September/October 2015, pp.46-55.

[8] "The 42 V's of big data and data science," https://www.kdnuggets.com/2017/04/42-vs-big-data-data-science.html

[9] P. K. D. Pramanik, S. Pal, and M. Mukhopadhyay, "Healthcare big data: A comprehensive overview," in N. Bouchemal (ed.), *Intelligent Systems for Healthcare Management and Delivery.* IGI Global, chapter 4, 2019, pp. 72-100.

[10] J. Moorthy et al., "Big data: Prospects and challenges," *The Journal for Decision Makers*, vol. 40, no. 1, 2015, pp. 74–96. https://www.grandviewresearch.com/industry-analysis/industrial-wireless-sensor-networks-iwsn-market

[11] A. K. Tiwari, H. Chaudhary, and S. Yadav, "A review on big data and its security," *Proceedings of IEEE Sponsored 2nd International Conference on Innovations in Information Embedded and Communication Systems*, 2015.

[12] M. B. Hoy, "Big data: An introduction for librarians," *Medical Reference Services Quarterly*, vol. 33, no 3. 2014, pp. 320-326.

[13] M. Viceconti, P. Hunter, and R. Hose, "Big data, big knowledge: Big data for personalized healthcare," *IEEE Journal of Medical and Health Informatics*, vol. 19, no. 4, July 2015, pp. 1209-1215.

[14] "Supply chain analytics: How it guides data-driven decision making (infographic)," https://usccg.com/blog/supply-chain-analytics-how-it-guides-data-driven-decision-making/

[15] "Big data in supply chain: Real-world use cases and success stories," November 2024, https://acropolium.com/blog/big-data-in-supply-chain-real-world-use-cases-and-success-stories/

[16] O. A. Gunes, "The role of big data in logistics and supply chain management," July 2023, https://www.threadinmotion.com/en/blog/the-role-of-big-data-in-logistics-and-supply-chain-management

[17] R. Fayolle, "5 Ways big data is transforming supply chains," January 2024, https://www.holocene.eu/blog-posts/5-ways-big-data-is-transforming-supply-chains

[18] "How is big data used to control food supply chains?" September 2022, https://www.aeologic.com/blog/how-is-big-data-used-to-control-food-supply-chains/

[19] I. Abbasi, "How is big data used to control food supply chains?" March 2022, https://www.azom.com/news.aspx?newsID=58688

[20] R. A. Vela, "Big data and analytics in supply chain operations," December 2023, https://www.azom.com/news.aspx?newsID=58688

[21] M. N. O. Sadiku, U. C. Chukwu, and P. O. Adebo, *Big Data and Its Applications.* Moldova, Europe: Lambert Academic Publishing, 2024.

[22] I. Rahimi et al. (eds.), *Big Data Analytics in Supply Chain Management: Theory and Applications.* Boca Raton, FL: CRC Press, 2020.

[23] H. K. Chan, N. Subramanian), and M. D. Abdulrahman (eds.), *Supply Chain Management in the Big Data Era (Advances in Logistics, Operations, and Management Science).* Business Science Reference, 2016.

[24] N. R. Sanders, *Big Data Driven Supply Chain Management: A Framework for Implementing Analytics and Turning Information Into Intelligence*. Pearson Education, 2014.

[25] P. W. Robertson, *Supply Chain Analytics: Using Data to Optimise Supply Chain Processes.* Taylor & Francis, 2020.

Figure 1 Supply chains [1].

Figure 2 The cloud word for big data [3].

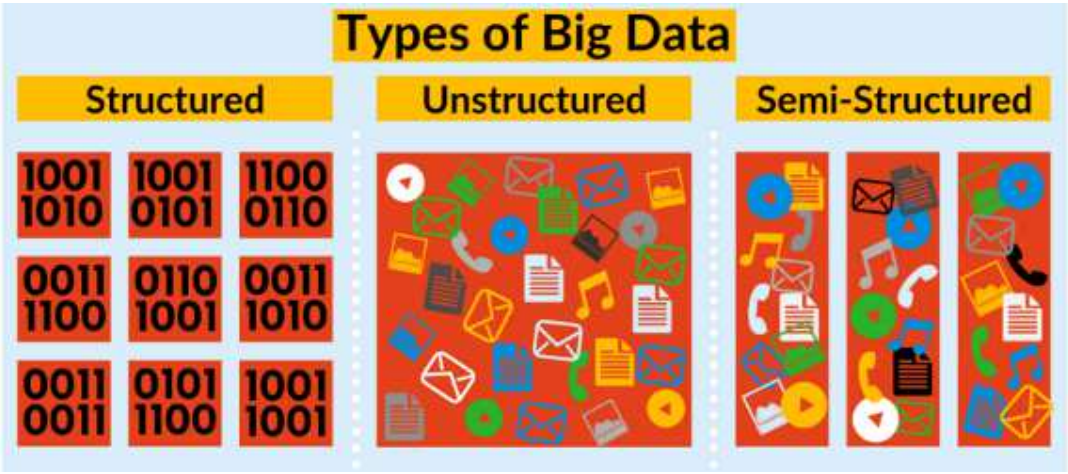

Figure 3 Types of big data [5].

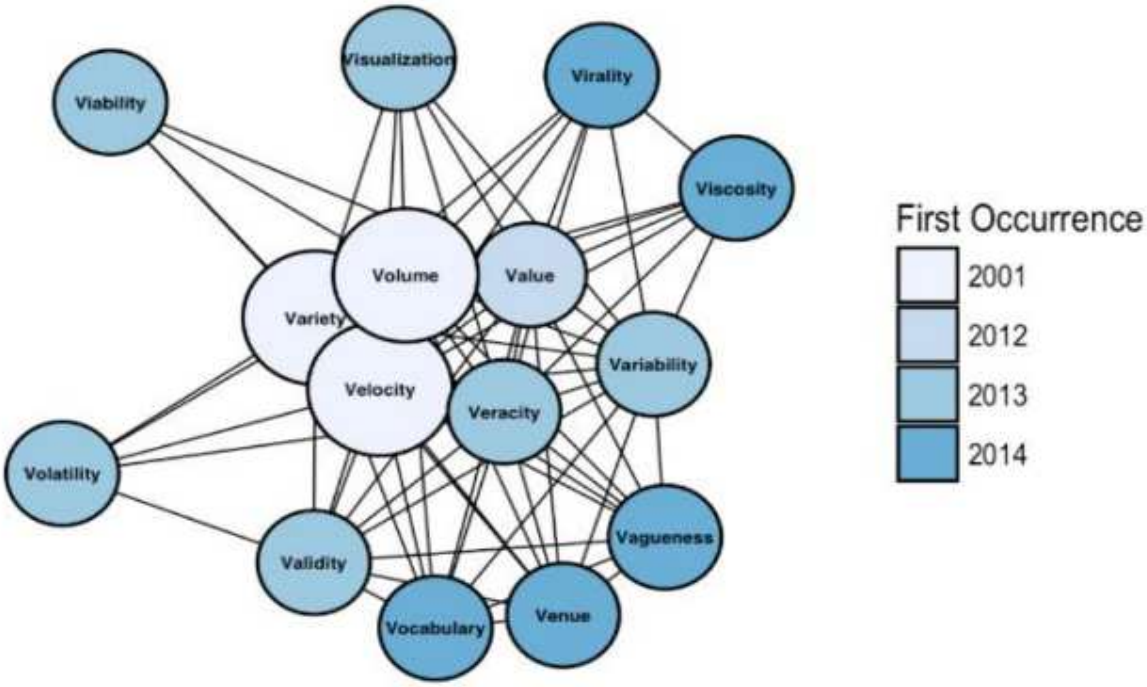

Figure 4 The 42 V's of big data [8].

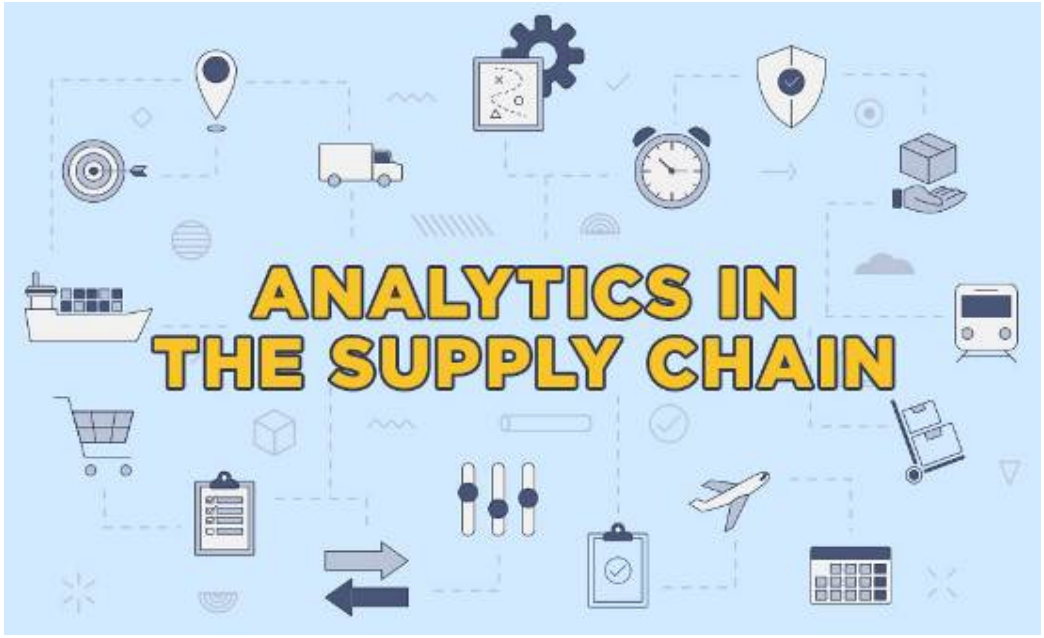

Figure 5 Supply chain analytics [14].

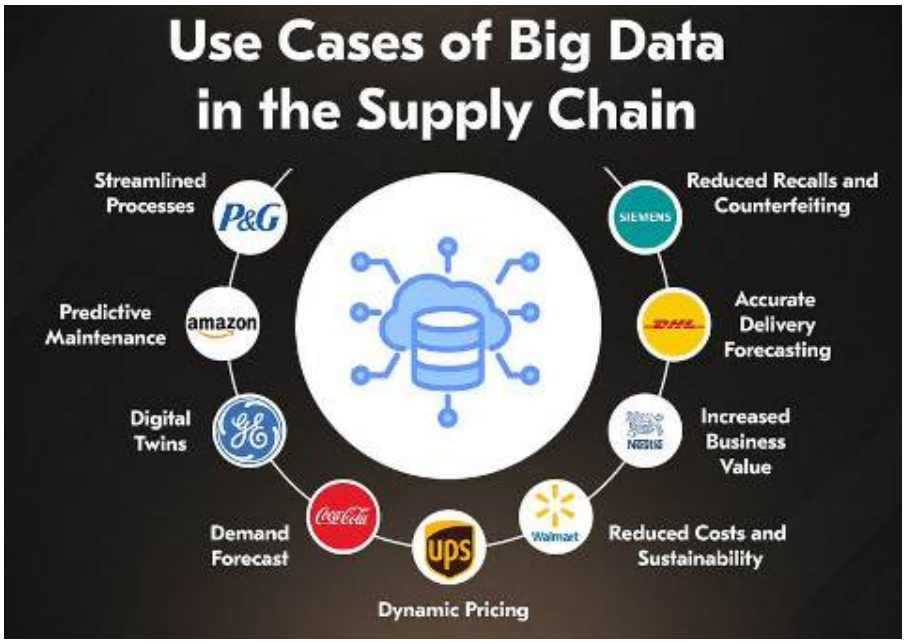

Figure 6 Companies using big data supply chain [15].

Figure 7 A typical Walmart store [16].

Figure 8 Tracking systems in the supply chain [15].

Figure 9 Food supply chain [19].

Figure 10 Some benefits of big data in supply chain [15].

Figure 11 Some challenges of big data in supply chain [15].